UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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Summary of the Environmental Protection Agency's Columbia River Temperature Assessment Model

The Columbia River Temperature Assessment Model (the 'Model') was developed in response to a demonstrated need to understand the how major temperature-altering sources contribute to the overall temperature regime in the Columbia/Lower Snake Rivers. The Model predicts temperature along the Columbia River from the Grand Coulee Dam to the Bonneville Dam and along the Snake River from Lewiston, Idaho to its confluence with the Columbia.

EPA's model is the result of more than a year of study, data collection and peer review. The model is a state of the art tool to estimate temperatures along the Columbia and Lower Snake Rivers. The model predicts average daily temperatures, specific to locations along the lengths of the Rivers, but averaged across the width and depth of the Rivers. Some of the key features of the model include: The ability to expand the modeled geographic area eastward, an algorithm that quantifies the uncertainty of the modeled results, a twenty-one year database of temperature and climate data and an extremely efficient design that will allow the model to run most scenarios in under five minutes.

The model also includes a summary of a biological study on salmon and the impacts of temperatures on their various life-stages.

Model Goals
The original goals for EPA's model development were to:

- Develop simulation methods for temperature assessment.
- Estimate uncertainty of water temperature simulations.
- Estimate temperature impacts of dams on the Snake and Columbia Rivers.
- Estimate temperature impacts of tributaries on the Snake and Columbia Rivers.

Model Scenarios
EPA's Model is very flexible and can be adapted to numerous management scenarios and even applied in different river systems. With the above stated goals as a reference point, the model currently analyzes the likelihood of exceeding a particular benchmark temperature (not necessarily water quality standards criteria) at different points along the Columbia and Snake Rivers under three separate scenarios. These three scenarios include:

1. A 21 year record of actual measured tributary temperature input, river flows and regional meteorology, assuming present river management (all dams in place).

2. A 21 year record of actual measured tributary temperature input, river flows and regional meteorology, assuming the absence of all dams downstream from Lake Roosevelt and below the confluence of the Clearwater and Snake River.

3. A 21 year record of actual measured river flows and regional meteorology, assuming the dams are in place and that tributaries contribute water temperatures equal to or less than 16°C.

The purpose of running these scenarios is to determine temperature conditions in the river given the most extreme river management possible, i.e., extremely cool water from tributaries is contrasted with removing the dams.

Preliminary Model Results
In general, the broad conclusion after running the above scenarios is that removal of the dams, as compared to increasing even the coolest water inputs from tributaries, would be most effective in bringing down temperatures in the Columbia-Snake system within the geographic scope of the Model.

More specifically, there are several other significant outputs from the model that provide potential policy guidance for the region. These are as follows:

- The Snake River is the most significant tributary to the Columbia River, with the potential to make the biggest difference in temperature modulation.
- Modeled results agree with measured results on the Snake River and show that temperatures are above state temperature standards during certain periods within the months of July, August and September.
- With the observed 21 year temperature average flowing into the lower Snake River reservoirs, removing the lower Snake River dams would significantly reduce average temperatures along the lower stretch of the Snake.

Audience and Uses for the Model
EPA will remain the technical lead on the model development and will rely on peer review as the mechanism to ensure its acceptance by the scientific community. The implications of the model's development, however, reach out to the region as a whole. Although the model is not packaged for general use at this time, EPA believes it to be a state-of-the art estimation of average daily temperature conditions in the Columbia and Lower Snake Rivers with the above scenarios in place. This is valuable information for managers and technical staff alike.

EPA understands that the complexity of the model limits broad distribution and use of the model by other parties. EPA does not consider this an impediment to the model's success as a regional reference tool as there are so many potential uses for it. It could be used to determine the consequences of operational adjustments on subsets of dams such as the lower Snake River dams or even adjustments on an individual dam in the Columbia or Snake River. It could be used to determine the effects of cold water discharges from reservoirs and implications of flow adjustments. All model results would be in terms of cross-sectional average daily temperatures in the rivers. Minimum and maximum temperatures are not outputs of the model.

Schedule for Release
The model and its documentation was completed by August 1999. EPA held a workshop on August 24, 1999, to review the model development and results. EPA will hold a meeting on September 17, 1999, 9:00 - 4:00, U.S. Army Corps of Engineers, U.S. Custom House, 220 NW 8th Street, Portland, OR. This session will provide a technical presentation of EPA's Model to describe the model, revisions resulting from the peer review and next steps.

For more information about EPA's Model, contact:

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